

WHAT IS CLAIMED IS:

- 1 1. A feedback system for down hole applications, comprising:
2 a down hole pumping system, comprising:
3 a pump; and
4 a fluid line connected to the pump;
5 at least one sensor disposed and configured to collect operating variable information;
6 a flow controller disposed in the fluid line; and
7 a control unit coupled to the sensor and configured to control operation of the flow
8 controller in response to input received from the at least one sensor.
- 1 2. The feedback system of claim 1, wherein the at least one sensor is disposed on the down
2 hole pumping system.
- 1 3. The feedback system of claim 1, wherein the at least one sensor comprises at least one of
2 a pressure sensor and a flow meter disposed in the fluid line.
- 1 4. The feedback system of claim 1, wherein the at least one sensor comprises a pressure
2 sensor disposed at an upper end of the pump.
- 1 5. The feedback system of claim 1, wherein the flow controller is a gate style pressure
2 valve.
- 1 6. The feedback system of claim 1, wherein the control unit is coupled to the down hole
2 pumping system and is configured to control the operation of the down hole pumping system in
3 response to the operating variable information.
- 1 7. The feedback system of claim 1, wherein the at least one sensor comprises a first
2 pressure sensor disposed in the flow line and a second pressure sensor disposed at an upper end
3 of the pump.

1 8. The feedback system of claim 1, wherein the operating variable information is selected
2 from at least one of a pressure value and a flow rate value and wherein the processing system is
3 configured to selectively issue a control signal to the flow controller according to a comparison
4 between the operating variable information and one or more target values.

1 9. The feedback system of claim 8, wherein the processing system is configured with timer
2 values that define a delay period before the control signal is issued.

1 10. The feedback system of claim 1, wherein the at least one sensor is configured to collect
2 operating variable information comprising at least one of a current value, a voltage value and a
3 load value.

1 11. The feedback system of claim 10, wherein the control unit is coupled to the down hole
2 pumping system and is configured to control the operation of the down hole pumping system in
3 response to the operating variable information.

1 12. The feedback system of claim 1, wherein the pumping system further comprises a motor
2 coupled to the pump.

1 13. The feedback system of claim 12, wherein the at least one sensor comprises a motor
2 sensor configured to collect operating variable information comprising at least one of a current
3 value, a voltage value and a load value from the motor.

1 14. The feedback system of claim 13, wherein the control unit is coupled to the down hole
2 pumping system and is configured to control the operation of the down hole pumping system in
3 response to the operating variable information.

1 15. A feedback system for down hole applications, comprising:
2 a down hole pumping system, comprising:
3 a pump;

4 a motor connected to the pump; and
5 a fluid outlet line connected to the pump;
6 a flow controller disposed in the fluid outlet line;
7 at least one sensor configured to collect operating information; and
8 a control unit coupled to the down hole pumping system and the at least one sensor and
9 configured to:

10 process the operating information received from the at least one sensor to
11 determine an operating variable value;
12 compare the operating variable value with a target value; and then
13 selectively issue a control signal to the flow controller.

1 16. The feedback system of claim 15, wherein selectively issuing the control signal to the
2 flow controller comprises issuing the control signal if the operating variable value is different
3 from the target value.

4 17. The feedback system of claim 15, wherein the at least one sensor comprises a fluid
5 pressure sensor and a motor sensor configured to collect operating information comprising at
6 least one of a current value, a voltage value and a load value from the motor.

7 18. The feedback system of claim 15, wherein the at least one sensor comprises a surface
8 pressure sensor disposable in the fluid outlet line and a well bore pressure sensor disposable in
9 the well bore.

1 19. The feedback system of claim 18, wherein the surface pressure sensor and the well bore
2 pressure sensor are disposable downstream from the flow controller.

3 20. The feedback system of claim 15, wherein the at least one sensor comprises a motor
4 operations sensor and wherein comparing the operating variable value with the target value
5 determines whether an adverse motor operating condition exists.

1 21. The feedback system of claim 20, wherein, if the adverse motor operating condition
2 exists, the control unit is configured to issue a motor halt signal if the adverse motor operating
3 condition persists for a predetermined period of time after the control signal is issued.

1 22. The feedback system of claim 15, wherein the at least one sensor comprises a motor
2 sensor.

1 23. The feedback system of claim 22, wherein the motor sensor is configured to collect
2 operating information comprising at least one of a current value, a voltage value and a load
3 value from the motor.

1 24. The feedback system of claim 23, wherein the control unit is configured to control the
2 operation of the down hole pumping system in response to the operating information.

1 25. The feedback system of claim 23, wherein the control unit is configured to halt the
2 operation of the down hole pumping system in response to the operating information.

1 26. A computer system for down hole applications, comprising:
2 a processor;
3 a memory containing a sensor program which, when executed by the processor,
4 performs a method comprising:

5 receiving a signal from at least one sensor configured to collect operating
6 information from a down hole pumping system;

7 processing the operating information to determine at least one operating variable
8 value;

9 comparing the operating variable value with a predetermined target value
10 contained in the memory; and

11 if a difference between the operating variable value and the predetermined target
12 value is greater than a threshold value, outputting a flow control signal to a flow controller.

- 1 27. The computer system of claim 26, wherein the threshold value is zero.
- 1 28. The computer system of claim 26, wherein the at least one sensor comprises at least one
2 a pressure sensor.
- 1 29. The computer system of claim 26, wherein the at least one sensor comprises at least one
2 pressure sensor disposed in a fluid outlet line coupled to the down hole pumping system and
3 having the flow controller disposed therein.
- 1 30. The computer system of claim 26, wherein the at least one sensor comprises at least one
2 of a pressure sensor and a motor operations sensor.
- 0 31. The computer system of claim 26, wherein the at least one sensor comprises a fluid
1 pressure sensor and a motor sensor configured to collect operating information comprising at
2 least one of a current value, a voltage value and a load value from a pump motor.
- 3 32. The computer system of claim 26, wherein the at least one sensor comprises a motor
4 operations sensor and wherein comparing the operating variable value with the target value
5 determines whether an adverse motor operating condition exists.
- 6 33. The computer system of claim 32, wherein, if the adverse motor operating condition
7 exists, the processor is configured to issue a motor halt signal if the adverse motor operating
8 condition persists for a predetermined period of time after the control signal is issued.
- 9 34. A method for operating a control unit to control peripheral devices while pumping a
1 well bore, comprising:
2 receiving a signal from at least one sensor configured to collect operating information
3 from a down hole pumping system;
4 processing the operating information to determine at least one operating variable value;

6 comparing the operating variable value with a predetermined target value contained in
7 the memory; and
8 if a difference between the operating variable value and the predetermined target value
9 is greater than a threshold value, outputting a flow control signal to a flow controller.

1 35. The method of claim 34, wherein the threshold value is zero.

1 36. The method of claim 34, wherein the sensor is submersed in a fluid contained in the well
2 bore.

1 37. The method of claim 34, wherein the sensor and the flow controller are disposed in a
fluid line.

38. The method of claim 34, wherein the operating variable value is indicative of head
pressure of fluid contained in the well bore.

39. The method of claim 34, further comprising receiving the flow control signal at the flow
controller and adjusting the flow rate of well bore fluid through a flow line.

40. The method of claim 34, wherein the down hole pumping system comprises a pump and
a pump motor and wherein the sensor is a motor sensor.

41. The method of claim 40, wherein the operating variable value collected by the motor
sensor is indicative of at least one of current, voltage and load.

42. The method of claim 34, further comprising adjusting the operation of the motor a
predetermined period of time after outputting the flow control signal.

43. The method of claim 42, wherein adjusting the operation of the motor comprises halting
the motor.

- 1 44. / A signal bearing medium containing a program which, when executed by a processor,
2 causes a method to be performed, comprising:
3 receiving an operating information signal from a down hole pumping system sensor;
4 processing the operating information signal to determine at least one operating variable
5 value;
6 comparing the operating variable value with a predetermined target value; and
7 if a difference between the operating variable value and the predetermined target value
8 is greater than a threshold value, outputting a flow control signal to a flow controller.

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